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(54) Odor absorbing material, saturant slurry and method for making same and use of the material.

(57) An odor-absorbing, non-dusting porous material and a method of making the same. The web material includes a porous base web (for example, a fibrous base web, such as a non-woven or paper web) having distributed throughout odor-absorbing particulate (such as zeolite). Alkaline salt or alkaline earth oxide particulate, to better effect removal of acidic malodor, desirably also is distributed throughout the base web, in the final product. The odor-absorbing particulate is bound to the base web (e.g., fibers of a fibrous base web) by a binding system, containing a binding agent. The binding system, in the odor-absorbing web materials, is transparent to the odors so as not to substantially effect the ability of the particulate to absorb odor-causing material. The odor-absorbing web material is formed by dipping a porous base web in a saturant slurry containing the odor-absorbing particulate (the slurry including an alkaline salt or alakaline earth oxide) and the binding agent, together with a surfactant; squeezing out excess saturant slurry from the web; and drying. Also disclosed are the saturant slurry and two specific uses of the odor-absorbing web material: (1) in personal care products such as catamenial devices and (2) in packages containing medical materials such as hospital gowns, which materials have been sterilized in the sealed package by gamma sterilization.

EP 0 392 528 A2

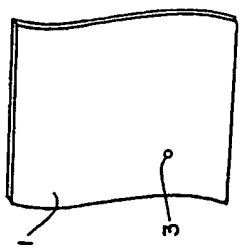


FIG. 1a

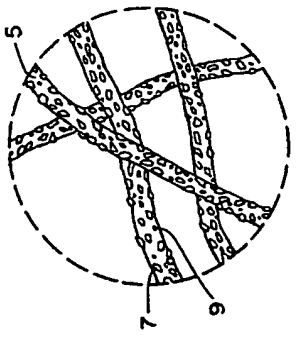


FIG. 1b

Od r abs rbing material, saturant slurry and method for making same and us of the material

The present invention relates to a material (e.g., fibrous web material) for absorbing odorous substances, methods for forming such material and saturant slurry compositions used for making such material. The invention is also directed to personal care products (such as sanitary napkins, tampons, diapers and incontinence pads) containing material for absorbing odorous substances; and sterilized sealed packages containing medical materials (such as hospital gowns), wherein offensive odors upon opening the sealed packages are avoided.

Sequestration of undesired odorous substances in a non-volatile form, by adsorption or absorption on a sorbent, is a known technique. One means for providing such sequestration is to incorporate particles of a material for absorbing odorous substances (hereinafter also odor-absorbing particulate material) in a sheet-like body; the odorous substances are absorbed by the particles of sorbent material, so as to sequester the undesired odorous substances.

It has been desired to provide odor-absorbing fibrous web material (that is, fibrous sheet material for absorbing odorous substances), having odor-absorbing particulate incorporated in a fibrous base web, the web material being non-dusting (that is, wherein particulate material in the web material does not fall out after manufacture of the odor-absorbing web material). It is desired to provide odor-absorbing web material which has good odor-absorbing properties and is non-dusting, yet which can easily and inexpensively be manufactured.

Various odor-absorbing web (e.g., sheet) materials have previously been disclosed. For example, U.S. Patent No. 2,690,415 discloses an odor-absorbing, flexible, sheet-like body which may be used in the capacity of a bandage, dressing, blanket or the like to absorb odors emanating from, for example, glandular excretions, wherein the sheet-like body contains one or more layers of granular odor-absorbing material uniformly dispersed throughout the body and secured therein (against displacement) by means of a permanently pliable adhesive. This patent discloses use of a web of open-mesh flexible woven material such as is commonly referred to as surgical gauze, the web being of open-mesh construction provided by relatively wide spacing between individual weft and warp strands, and is provided in the regions wherein the weft and warp strands overlap one another with discrete particles or masses of a permanently pliable adhesive. This patent also discloses that an exemplary adhesive includes a water-emulsion asphaltic-type of adhesive, or one of the synthetic resinous or latex base adhesives using solvents or plasticizers that may be easily evaporated or driven-off by heat treatment of the adhesive after application to the gauze web. This patent further discloses that after application of the adhesive, the odor-absorbing material in its granular form may be sprayed or sprinkled upon the adhesive-containing areas of the gauze web on one or both sides thereof, or the adhesive-containing web may be passed through a mass of the granular material to cause adherence between the individual granules of odor-absorbing material and the discrete particles of adhesive.

U.S. Patent No. 4,289,513 discloses sorption paper (a relatively dense, non-porous paper as compared to filter paper) for absorbing odors associated with, for example, body waste devices such as sanitary napkins and disposable diapers, wherein a fibrous base paper material, which is resiliently flexible, is loaded with activated sorption particles. In its specific use for absorbing odors of body waste, the sorption paper is inserted in the sanitary napkin or diaper, to remove the odors. The sorption sheet material disclosed in U.S. Patent No. 4,289,513 includes a fibrous base paper material which is resiliently flexible, with activated sorption particles dispersed in the fibrous base material, such particles being substantially uniformly dispersed throughout all dimensions of the fibrous base material, in an amount up to about 85% based on the weight of the base material. However, this patent does not disclose how the particles are uniformly dispersed throughout all dimensions of the fibrous base material. This patent discloses that there is a substantial absence of loose, dusty sorption particles due to use of a particular binder material, such binder material being a latex-type binder, preferably an anion polymeric emulsion of latex material (the latex materials including polyvinyl chloride copolymer, acrylics, vinylidene chlorides, acrylonitriles, vinyl acetates, polybutadiene, styrene butadiene, phenolic resins and combinations thereof). This patent further discloses that the sorption particles can include activated carbon, activated silica gel, polymeric absorbent materials, molecular sieves, ion exchange resins and other carbonaceous absorbent materials.

U.S. Patent No. 4,525,410 discloses a fiber article having anti-bacterial properties, which article retains zeolitic particles having a bactericidal activity in fibers having fused intersection points. This patent discloses that the zeolite particles are capable of contacting with external fluids through cavities in th fibers, and that the fiber article is composed of a mixed fiber assembly including (1) natural fiber staples or synthetic fiber staples, and (2) fiber staples containing low-melting thermoplastic synth tic fibers having a

melting point at least 30° C lower than the melting point or the decomposition point of the aforesaid natural fiber staples or synthetic fiber staples. This patent discloses that at least a part of the intersection points of the staples of the mixed fiber assembly have the intersecting fibers stuck to each other by the fusion of the low-melting thermoplastic synthetic fibers. The zeolitic particles are incorporated in the fiber body by having the zeolitic solid particles contact the mixed fiber assembly while the low-melting thermoplastic synthetic fibers are in a molten state, with pressure then being applied and then the mixed fiber assembly being cooled to fix the particles onto the mixed fiber assembly.

U.S. Patent No. 4,748,065 discloses a spun-laced fabric having incorporated therein adsorbent carbonized particles, the particles being distributed over the entire fabric and dispersed throughout the cross-section of the fabric, but with more of the particles being located near the surface of the fabric, with the particles being held in place by an organic binder. This patent discloses that the fabric incorporating the adsorbent carbonized particles can be produced by brush-coating a base spun-laced fabric, on each side, with a mixture of aqueous slurries containing an aqueous slurry of activated carbon absorbent particles and an aqueous slurry of a synthetic copolymeric latex (including a polymer of ethyl acrylate and poly(vinylidine chloride/methyl acrylate/itaconic acid)).

While each of the foregoing patents describes various materials for removing odors and/or noxious materials, it is desired to provide a more satisfactory odor-absorbent sheet material. In particular, it is desired to provide a more satisfactory web material that is both non-dusting and effectively removes odors, yet which can be manufactured inexpensively. It is also desired to provide such web material, which has a clean, unobtrusive appearance. It is further desired to provide such web material, which has applications in many different fields where odors arise (e.g., in refrigerators, or other enclosed spaces where there is poor exchange of fresh air).

The above objects are solved by the odor absorbing material of independent claims 1 and 11, by the saturant slurry of independent claim 38 and by the method of forming a material for absorbing odorous substances of independent claim 46. Further advantageous features of the material are evident from dependent claims 2 to 37. Further advantageous features of the saturant slurry are evident from dependent claims 39 to 45. Further advantageous features of the method are evident from dependent claims 47 to 51.

In the previously discussed U.S. Patent No. 4,289,513, specific applications for use of sorption paper to absorb odors are disclosed. One of the applications disclosed therein is to absorb odors emanating from devices for absorbing body liquid wastes, such as catamenial devices. Such odor can be caused by the following materials in body wastes, or formed from body wastes, absorbed in catamenial devices: (1) triethylamine; (2) pyridine; (3) furaldehyde; (4) isovaleric acid; and (5) n-propyl sulfide. Use of the material of this invention according to independent claim 53 and dependent claim 54 provides for absorbing these odors.

As a further area where odor is a problem, in the gamma-sterilization of medical materials (for example, hospital gowns made from polypropylene fibers) in a sealed package, an unfortunate and highly aggravating side effect of the irradiation sterilization of the polypropylene materials is that a highly offensive odor is present upon opening of the package.

Thus, in manufacturing such medical material packages, initially the medical material is made and subjected to various treatments, such as to make the materials alcohol-repellent and lint-free. The materials are then packed into a package, with the package then being sealed. Thereafter, the sealed package is subjected to gamma-irradiation sterilization, to sterilize the medical material. However, the gamma sterilization causes malodorous materials to form in the sealed package, so that when the package is opened a highly offensive odor is present. Accordingly, it is also desired to avoid the offensive odors present upon opening of the medical material-containing packages. Use of the material of this invention according to independent claim 55 absorbs these odors.

It is also desired to provide catamenial devices, such as sanitary napkins and tampons, wherein odors emanating from such devices, due to liquid body wastes absorbed in such catamenial devices, are avoided. These objects are solved by the catamenial devices according to independent claims 56 and 64 and further advantageous features of these catamenial devices are evident from dependent claims 57 to 59.

It is also desired to provide sealed sterilized packages, containing medical (for example, surgical) materials illustrated by hospital gowns, wherein offensive odors upon opening the sterilized packages are avoided. It is further desired to provide sterilized medical packages and catamenial devices, wherein odors emanating therefrom are avoided, while dusting of odor-absorbing particulate material (on, for exampl , the surgical material) is avoided. It is also desired to avoid such odors by a technique that can be provided inexpensively y t effectively, and y t which has a clean and unobtrusive appearance. The objects are solved by the medical material package of independent claim 60 and furth r advantageous features of this package are evident from dependent claims 61 to 63.

While th above-discussed documents may disclose products, processes and apparatus which xhibit some of the characteristics of th present invention, non of them discloses or suggests the present invention (including the advantages thereof), which achieves the objectives as discussed below.

The present invention to provide web materials (for example, sheets or pads) for absorbing odorous substances, and a method of making such web materials.

The present invention further provides such web materials for absorbing odors, the webs being fibrous webs and the web materials including particulate material that absorb odorous substances.

The present invention also provides web materials for absorbing odorous substances, including acidic odorous substances, which web materials can be inexpensively manufactured.

The present invention also provides web materials for absorbing odorous substances, the web materials containing odor-absorbing particulate material, which web materials are non-dusting and wherein the odor-absorbing particulate material is distributed throughout the webs.

The present invention additionally provides web materials, for absorbing odorous substances, that are non-dusting and have a pleasing white color (that is, that have a white color such that a clean and unobtrusive appearance is achieved).

The present invention also provides an aqueous saturant slurry to be used in making web materials for absorbing odors, the slurry including odor-absorbing particulate material and a binder for binding the odor-absorbing particulate material to the web materials (e.g., fibers of the web materials).

The present invention further provides a feminine care product (for example, a catamenial device, such as a sanitary napkin or tampon), wherein odors are prevented from emanating therefrom, notwithstanding that body waste products, such as menstrual fluids, are absorbed therein.

The present invention also provides packages containing sterilized medical materials, sterilized by gamma sterilization, wherein odor from the packages, upon opening the sterilized packages, is avoided.

The present invention achieves each of these objects and advantages utilizing a web material (e.g., fibrous web material) for absorbing odorous substances. The web material contains particulate material, which absorbs odorous substances, bound to a base web (e.g., fibers of a fibrous base web) by a binding system. The binding system includes a binding agent. The binding system, as part of the product (that is, as part of the final product, wherein a binding agent has been applied to the web (in a wet form) and dried, to thereby provide the binding system to bind the particuate material to the web material) is transparent to the odors (by transparent to the odors, we mean the binding system does not substantially block access to the particulate material by the odorous substances). The odor-absorbing particulate material is distributed throughout the web, thereby providing maximum efficiency of odor-absorption (that is, absorption of odorous substances). Notwithstanding binding of the odor-absorbing particulate materials to the web material, the web material has sufficient open volume so that the odorous substances can pass into contact with all of the odor-absorbing particulate.

Accordingly, a product can be provided wherein the particulate material satisfactorily binds to the web material so that the particles do not fall out of the web material (that is, the product is non-dusting). Due to use of the binding system transparent to odors, absorption of odorous substances is not adversely affected notwithstanding use of the binding system. Moreover, the bonding of the odor-absorbing particulate material to the web material maximizes surface contact between the absorbent and odorous substances, maximizing removal of the odorous substances.

The web material (for example, fibrous web material) can be any of many porous forms. For example, the fibrous web material can be a non-woven sheet (pad) of synthetic fibers, such as a spunbond web product such as described in U.S. Patent No. 3,692,618 to Dorschner, et al. with respect to forming of filaments, and U.S. Patent No. 3,855,046 to Hansen, et al. with respect to bonding to form the web, the contents of each of which are incorporated herein by reference in their entirety. Alternatively, the fibrous web material can be a web of meltblown fibers, formed as described in Naval Research Laboratory Report No. 11,437, dated April 15, 1954 and in U.S. Patent No. 3,676,242 to Prentice, the contents of each of which are incorporated herein by reference in their entirety. As can be appreciated, each of these forms of web material are known in the art. The web material can be a paper sheet. Moreover, the web material can be a laminate, such as a laminate of a spunbond sheet and meltblown sheet, a three-layer laminate of two spunbond sheets sandwiching a sheet of meltblown fibers, etc. The web material need not be fibrous (e.g., it can be a porous foam material). The web material itself can absorb odorous substances, thereby even further improving the product of the present invention for absorbing odorous substances.

The base web must have a void volume greater than 75%. In particular, the base web must have a large nough void volume so as to ffectively be impregnated and have sufficient odor-absorbing particulate material r tained therein, whil still permitting effectiv transit of gases therethrough so as to absorb odorous substances from such gases.

The percent void volume is determined from the following equation and procedure:

% Void Volume = $1 - (d_T/d_P) \times 100$

d_T = the apparent density of the base web. This is determined by carefully weighing and measuring the length, width and thickness of a rectangular piece of the base web. The apparent density is the weight in grams divided by the volume in cubic centimeters.

d_P = the absolute density of the base web. The absolute density is calculated from the weight fractions of the various fiber components and of the respective absolute densities, i.e., the reciprocal sum of the volume fractions in cubic centimeters from one gram of base web.

An essential part of the odor-absorbing web material of the present invention is odor-absorbing particulate material, incorporated in the above-described web material. The odor-absorbing particulate material is desirably a molecular sieve material, such as a zeolite (zeolite is defined in U.S. Patent No. 4,525,410, the contents of which are incorporated herein by reference). Such zeolite can be a natural or synthetic zeolite. Use of zeolites are particularly desirable in connection with the present invention since they are white to off-white, so that sheet products having zeolite as the particulate material for absorbing odorous substances can have a clean, unobtrusive appearance. The particle size range of the zeolite is, illustratively, 1-5 µm. Other materials which can be utilized for the odor-absorbing particulate material include activated carbon, chitin and ion-exchange resins. Of course, use of activated carbon (which is black) does not provide the clean, unobtrusive appearance achieved when utilizing zeolites.

In addition to the odor-absorbing particulate material such as zeolite, the web of the present invention should also include an alkaline salt or alkaline earth oxide (both hereinafter referred to as "alkaline salt"), to provide increased removal of acidic odorous substances. The alkaline salt (in particulate form) can be bound to the fibers utilizing the same binder used for binding the, e.g., zeolite, so that both the zeolite and the alkaline salt can be incorporated in the base web material in the same processing step. As a trade-off, incorporating an alkaline salt in the base web material decreases absorption of strongly basic odorous substances, such as triethylamine (although it does not decrease absorption of weakly basic odorous substances such as pyridine).

The alkaline salts are substances that would result in a pH greater than 7.0 when in solution. As a result, acid materials react with basic salts such as:

$$\underset{\text{(acid odor)}}{HX} + \underset{\text{(alkaline salt)}}{NaHCO_3} \rightarrow \underset{\substack{\text{(salt of acid odor)-non-odorous}}}{NaX} + H_2O + CO_2\uparrow$$

The alkaline salt (or alkaline earth oxide) can be solubilized when applied to the web; in such case, upon drying the alkaline salt (or alkaline earth oxide) precipitates out of solution and deposits on the web material (e.g., fibers of the web material). Alternatively, the salt or oxide can be in a slurry of fine particles upon application to the web material, deposited therefrom on the web material. In either case, the particles are attached to the web by the binding system, as with the particulate material (e.g., zeolite).

An important aspect of the present invention is that the binding system, including a binding agent (the binding system binding the particulate material for absorbing odorous substances, and the alkaline salt particulate, to the web material) permits the odorous substances to pass therethrough to be absorbed in the particulate material and to permit acidic odorous substances to be removed by the alkaline salts, while still acting to bond the particulate material and alkaline salt particulate to the web material. Thus, not only is effective bonding between the web material and particulate material (and alkaline salt particulate) achieved (whereby the odor-absorbing web material is non-dusting), but also effective absorption and removal of odorous substances is achieved. Illustrative binding agents include polyvinyl alcohol; methyl cellulose; carboxy methyl cellulose; starch, including ethylated and oxidized derivatives thereof; and various polymer emulsions (latexes).

The odor-absorbing particulate material (or both odor-absorbing particulate material and alkaline salt particulate) is distributed throughout the base web material and bonded to the base web material by the binding agent. For example, where the base web material is fibrous, the odor-absorbing particulate material (and alkaline salt particulate) are bound to the fibers (along the lengths of the fibers, on th surfaces thereof). Accordingly, the total surface area of the particulate exposed for absorption is maximized, so as to maximize effectiveness of the odor-absorbing web material.

The present invention is also directed to a slurry used for applying the odor-absorbing particulate

material (or such particulate material and alkaline salt particulate) to the base web. The slurry is an aqueous slurry, and includes (in addition to water) the particulate material to be deposited in the web, a wetting agent (surfactant) and the binding agent.

The present invention is also directed to a method for forming the odor-absorbing web material. Specifically, the above-described slurry is caused to impregnate the base web, and the impregnated base web is then dried.

As an illustrative technique, the base web can be dipped in the slurry (the slurry having the various components, including the odor-absorbing particulate material, uniformly distributed therethrough), with the web material (after being dipped in the slurry) being squeezed, to control the amount of material added to the base web. Desirably, the squeezing can be performed by passing the impregnated web between two rollers. Such technique of dipping the web and then squeezing by passing between two rollers facilitates a continuous process, by passing the base web from a roll thereof into the slurry and then between the two rollers, with the base web then being dried (for example, by passing over conventional steam can equipment); of course, the wet web can be air-dried, for example, at room temperature.

By the present process, the amount of material added into the base web can be controlled (both by controlling the amount of particulate material in the slurry, and by controlling the squeezing of the base web). Furthermore, a simple continuous process can be utilized for forming the odor-absorbing web material.

The present invention also provides specific applications for the odor-absorbing web material of the present invention. Specifically, according to the present invention, the odor-absorbing web material of the present invention can be incorporated in a feminine care product (for example, a catamenial device such as a sanitary napkin or tampon) so as to absorb odors and prevent such odors from emanating from such device. Various odors for which the present invention is applicable, originating in the vagina, are described in Huggins, et al., "Vaginal Odors and Secretions", Clin. Obs. Gyn., 24 (1981), pages 355-377. Illustratively, the odor-absorbing web material, containing zeolites or other odor-absorbing particulate material, and incorporated in the feminine care product according to the present invention, can absorb odorous substances such as triethylamine, pyridine, furaldehyde, isovaleric acid and n-propyl sulfide, thereby preventing such substances (and, correspondingly, their odors) from emanating from the feminine care products, and, accordingly, acting as a deodorant therein.

A further application for the odor-absorbing web material of the present invention is in a package containing medical material, such as hospital gowns. Such odor-absorbing web material absorbs odorous materials caused by gamma sterilization of the medical material, after sealing of the package. Accordingly, upon opening the sealed package, the offensive odors are avoided. The odor-absorbing web material of the present invention is inert (that is, is not functionally effected by the gamma sterilization), so that notwithstanding the presence of the odor-absorbing web material during the gamma sterilization treatment, the odor-absorbing web material can still act to absorb offensive odors in the sealed package.

Thus, the present invention achieves an odor-absorbing web material that effectively removes odorous substances and is non-dusting, yet which can be manufactured easily and in a continuous process, and can be inexpensive to manufacture. Moreover, such odor-absorbing web material can be utilized in feminine care products; and in sealed packages, containing medical materials, that have been subjected to gamma sterilization, so as to avoid odors emanating from such device and package while achieving the other objectives of the present invention.

Fig. 1a shows, schematically, an odor-absorbing web material of the present invention, and Fig. 1b shows, in detail, a portion of the web material;

Fig. 2 shows a cross-section of a fiber, having odor-absorbing particulate material bound thereto, according to the present invention;

Fig. 3 is a schematic view of apparatus for impregnating the base web with saturant slurry and for controlling the amount of material added to the base web;

Fig. 4 schematically illustrates the absorbing portion of a sanitary napkin according to the present invention; and

Fig. 5 shows a medical package according to the present invention.

While the invention will be described in connection with specific and preferred embodiments, it will be understood that it is not intended to limit the invention to those embodiments. On the contrary, it is intended to cover all alterations, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

The pres nt invention contemplates a web material for absorbing odorous substances, having particulate material, which can absorb odorous substances, bound to a base web (e.g., fibrous base web) by a binding system, including a binding agent, that is transparent to the odorous substances. The odor-

absorbing particulate material is distributed throughout the web material, for example, homogeneously throughout the web material.

As stated previously, in order to maximize the functional surface area of the odor-absorbing sheet material, the base (carrier) web is to have a percent void volume greater than 75%. The following Table I shows various basis weights of paper and non-woven materials, both single sheet layers and laminates, and their respective percent void volume, which can be utilized as the base web of the present invention.

Table I

Void Volume Comparison	% Void Volume
103 g/m^2 spunbond web	80
68 g/m^2 spunbond web	80
37 g/m^2 spunbond/meltblown/spunbond laminate	81
58 g/m^2 spunbond/meltblown laminate	78
45 g/m^2 cellulose web of softwood Kraft paper	77
96 g/m^2 cellulose web of softwood Kraft paper	77
124 g/m^2 cellulose web of softwood Kraft paper rich in alpha pulp	82
184 g/m^2 cellulose web of softwood Kraft paper rich in alpha pulp	81
130 g/m^2 cellulose web with 100% alpha pulp	79

Illustratively, the base webs, when made of a non-woven web, can have a basis weight in the range of 31-103 g/m^2, most preferably 38 g/m^2.

The most preferred base web is a laminate of spunbond/meltblown/spunbond webs, formed conventionally. The base webs can be made of, e.g., polypropylene. However, the base webs are not limited to polypropylene, and can be made of other polymer materials; e.g., other polymer materials, including thermoplastic polymers such as polyamides, polyesters, polyethylene and other polyolefins, that can be spunbond or meltblown. The webs can also be made of cellulose (for example, can be paper webs).

As indicated previously, the preferred odor-absorbing particulate materials for the present invention include zeolites, both natural and synthetic zeolites. Illustratively, natural zeolites which can be utilized include clinoptiolite, Types XY and SC supplied by Teague Mineral Products, and "Zeobrite™", supplied by Zeotech Corp.

Synthetic zeolites include "SMELLRITE®" and "ABSCENTS™", each supplied by Union Carbide Corp. "ABSCENTS™" is a pure white material with a median particle size in the range of 3-5 µm which is insoluble in water and organic solvents and is capable of tolerating temperatures as high as 800° C and is a preferred absorber. It can effectively remove separately contained odor-causing compounds including organic acids, aldehydes, ketones, mercaptans, ammonia and indoles. Where these odor-causing compounds are contained in combination, various of the odor-causing compounds are absorbed preferentially, and when organic acids are included in such combination with other compounds the organic acids are not absorbed efficiently.

Various zeolite materials, useful for eliminating organic odors, are described in U.S. Patent No. 4,795,482, to Gioffre et al, the contents of which are incorporated herein by reference in their entirety.

In addition to the zeolites, ion-exchange resins, such as the "AMBERLITE® - XAD" series of ion-exchange resins, can be utilized. As indicated previously, other odor-absorbing particulate material, such as activated carbon and chitin, can be utilized; however, such materials have drawbacks, including, for example, that activated carbon is black such that the final product does not have an unobtrusive appearance. Accordingly, the desired odor-absorbing particulates are the zeolites.

As indicated previously, the odor-absorbing particulates of the present invention can include, in addition to, for example, the zeolites, various alkaline salts and alkaline earth oxides. Alkaline salts and alkaline earth oxides have a particular advantage in removing acidic odorous substances. These salts and oxides, illustratively, include the following: sodium bicarbonate ($NaHCO_3$), potassium bicarbonate ($KHCO_3$), lithium bicarbonate ($LiHCO_3$), sodium carbonate (Na_2CO_3), potassium carbonate (K_2CO_3); disodium hydrogen phosphate (Na_2HPO_4), sodium dihydrogen phosphate (NaH_2PO_4), trisodium phosphat (Na_3PO_4), magnesium oxide (MgO), calcium oxide (CaO), tetrasodium pyrophosphate ($Na_4P_2O_7$), tetrapotassium pyrophosphate ($K_4P_2O_7$), tetralithium pyrophosphate ($Li_4P_2O_7$), and disodium dihydrogen pyrophosphate ($Na_2H_2P_2O_7$). Of the listed alkaline salts, sodium bicarbonate is preferred. As discussed further in the

following, the alkaline salt can be incorporated in the saturant slurry containing the, e.g., zeolite, for saturating the base web material.

Various binding agents used for binding the odor-absorbing particulates to the fibers will now be discussed. These binding agents can be listed in various classes, including polyvinyl alcohol, starch and latex/emulsions.

The polyvinyl alcohol binding materials are desirably partially hydrolyzed, and are preferred since they adhere to hydrophobic surfaces, have a low viscosity and low molecular weight, and have stability to gamma-radiation (as compared to latex systems, for example). A specific polyvinyl alcohol utilizable as a binder in the present invention includes "VINOL™ 205", a partially hydrolyzed (hydrolysis 87.0 - 89.0%) polyvinyl alcohol having a viscosity of 5-6 mPa.s (5-6 cps) and a pH (in 4% aqueous solutions) of 4.5 - 6.5. This polyvinyl alcohol is a product of Air Products & Chemicals Co., Inc.

Starch materials which can be used as binding agents in the present invention include derivatives of starch, such as ethylated and oxidized materials. Specific illustrative starch derivatives include Penford Gums by Penford Products Company, which are derivatives of cornstarch in which hydroxyethyl groups have been substituted for hydrogens on the hydroxyl groups in the starch molecule. The Penford Gums are known gums, having known uses in the textile industry.

Illustrative latex/emulsions which can be used as binding agents according to the present invention include emulsions of acrylic polymer; styrene butadiene/rubber; nitrile/butadiene/rubber; acrylonitrile/butadiene/styrene terpolymer; vinyl chloride polymer; polyvinyl acetate polymer; and ethylene vinyl acetate polymer. Specific illustrative emulsions include known paper saturants, such as "HYCAR®" 26334 acrylic latexes and nitrile latexes, from B. F. Goodrich Co., and the "RHOPLEX®" acrylic emulsions, from Rohm & Haas Co. Of these latex/emulsions, of particular interest is "RHOPLEX®" NW-1715 acrylic emulsion.

Figs. 1a and 1b, and Fig. 2 illustrate the odor-absorbing material according to the present invention. Fig. 1a shows the odor-absorbing web material 1, while Fig. 1b shows, in greater detail, the fibrous material at location 3 of the web 1. As seen in Fig. 1b, the individual fibers 5 have distributed on the surface thereof along their entire length the zeolite particulate material 7 and the alkaline salt (for example, sodium bicarbonate) particulate 9, in an illustrative example. As shown in Fig. 2, the fibers 5 have the zeolite 7 and sodium bicarbonate particulates distributed around the entire circumference thereof, bound to the fibers by the binding agent.

As indicated previously, the odor-absorbing particulate material can be incorporated in the base web by dipping the base web in a saturant slurry. A saturant formulation, in general, would include a wetting agent, in addition to the particulate absorbent and the binding agent. The wetting agent (for example, surfactant), would be used to wet the saturant slurry, including particulate material, onto the base web (e.g., fibers of a fibrous base web), and would be included in the saturant slurry in amounts of 1-10% by weight of the saturant slurry. The most preferred wetting agents are "TRITON™" surfactants, particularly "TRITON™ X-100". The "TRITON™" surfactants are products of Rohm & Haas Co. The X-100 brand has a common name of octylphenoxypolyethoxyethanol and is a biodegradable, non-ionic surfactant. "TRITON™ N-101" (common name nonylphenoxypolyethoxyethanol), another product of Rohm & Haas Co., can also be utilized. Anionic wetting agents, such as sodium dioctyl sulfosuccinate, and fugative alkyl alcohols, such as isopropanol, butanol and hexanol can also be used as the wetting agent. These wetting agents (surfactants) are known wetting agents in the art.

Various saturant slurry formulations will now be set forth. Generally, the saturant slurry formulation includes in the dry formulation (apart from the water included therein), for every 100 parts by weight of particulate odor-absorbing material such as zeolite, 5-15 parts by weight of the wetting agent, 1-40 parts by weight of alkaline salt particulate, and 5-50 parts by weight of the binder; if the alkaline salt is included, such alkaline salt is preferably included in an amount of 5-40 parts by weight. More preferably, the alkaline salt is included in the saturant slurry formulation in amounts of 5-25 parts by weight.

As a specific desired formulation, the saturant includes, in dry parts, per 100 parts of, e.g., zeolite, 20 parts by weight of alkaline salt, 10 parts by weight of wetting agent and 10 parts by weight of binder.

Desirably, with a fibrous base web having a basis weight of 31 - 102 g/m^2 (ideally, 38 g/m^2), the pick-up of saturant (in dry weight) on the base sheet would be 15-75 parts by weight per 100 parts by weight of fiber.

Specific saturant formulations, including water, the respective saturant formulations including "ABSCENTS™" and activated carbon, respectively, will now be set forth in Table II. In this Table II, the activated carbon of the activated carbon dispersant was provided by milling for one hour, prior to incorporation in the saturant slurry. In the following Table II, the % solids are % by weight, while the dry and wet amounts are parts by weight.

Tabl II

"ABSCENTS™" Saturant			
		Parts by Weight	
	% by weight Solids	Dry	Wet
Water			300
[1] "TRITON™ X-100" solution	10	10	100
[2] "ABSCENTS™"	100	100	200
[3] "VINOL™" 205 solution	10	10	100
Sodium bicarbonate	100	20	20
Totals	22.6*	140	620

* Assuming base web of 96 g/m^2 cellulose web of softwood Kraft paper or laminate of spunbond/meltblown. The % by weight add-on was 29%.

Activated Carbon Saturant

Water			100
[1] "TRITON™ X-100" solution	10	10	100
Activated carbon dispersion	20	100	500
[3] "Vinol™" 205 solution	10	10	100
	15*	120	800

* Assuming base web of 96 g/m^2 of a cellulose web of softwood Kraft paper. The % add-on was 17% by weight.

"ABSCENTS™" Saturant

Water			427.3
[1] "TRITON™ X-100" solution	20	1	5.0
[2] "ABSCENTS™"	100	100	100.0
[4] "RHOPLEX®" NW 1715	44	10	22.7
	20*	111	555.0

*Assuming base web of cellulose web of softwood Kraft paper, with a dry add-on of 31% by weight.

[1] Product of Rohm & Haas Co.
[2] Product of Union Carbide Corp.
[3] Product of Air Products & Chemicals Co., Inc.
[4] Product of Rohm & Haas Co.

As indicated previously, the saturant slurry is incorporated in the base web by dipping the base web material in the saturant slurry. Of course, care should be taken to ensure that the odor-absorbing particulate (such as zeolite), as well as the other components of the slurry, is uniformly and homogeneously dispersed throughout the saturant slurry during use of such slurry for incorporating material in the base web material. Conventional means (e.g., vibrating the slurry) can be used to ensure such homogeneous and uniform dispersion.

Fig. 3 shows, schematically, how the base web can be dipped into the saturant slurry, and then squeezed, to squeeze out slurry material, so as to control the material added-on into the web. Specifically, base web 11, in a continuous (roll) form, is dipped into the saturant slurry 13 in container 15, and then after passage out of the slurry, is passed between rollers 17 and 19 for squeezing excess slurry from the base web, to control add-on. Specifically, the rollers 17 and 19 are respectively a silicone rubber roller and a stainless steel roller. The silicone rubber roller has a Shore hardness of 60 (A scale), illustrativ ly. The nip pr ssure between the two rollers illustratively ranges between 0.268-0.446 kg/cm (1.5-2.5 lb/lin.in.), so as to squeez out excess slurry.

As is clear from Fig. 3, the excess slurry squeezed out of the web mat rial passes into tank 21, and

then is transferred back into the bath 13, in tank 15, through pipe 23. After the web material passes between th two rollers, it can then be dried. Desirably, the material is dried over conventional steam cans. However, use of such steam cans is not required, and the web material impregnated with saturant can be air-dried.

Upon drying, the odor-absorbing web material, having odor-absorbing particulate material (such as zeolite), with an alkaline salt particulate, bound uniformly throughout the base web, can be cut into desired sizes for intended final use.

Shown in the following Table III is the percentage of odor reduction provided utilizing a synthetic zeolite in powder form versus such zeolite incorporated in a base web.

In Table III, as well as the following tables showing absorbing ability of various odor-absorbing web materials, absorbing ability was determined using a gas chromatography headspace analysis, described in the following. Using a volatile mixture of 100µl pyridine, 100µl n-propyl sulfide, 100µl furaldehyde, 100µl triethylamine, and 200µl isovaleric acid, a 10µl volume of such mixture was introduced by a pipetman, into a 40-ml EPA sample vial and sealed with a mininert screw cap. This serves as a blank to ensure the presence of all components of the volatile mixture.

A known quantity of material to be tested is placed in a 40-ml EPA vial. After the addition of 10µl of the mixture described above the vial is sealed with a mininert screw cap and is incubated at 37° C for 4 hours. (When testing a sheet form, an untreated sheet acts as the control and is run under these same conditions.) After 4 hours incubation a 10µl headspace sample from each vial is injected into the GC using the parameters listed in the following. The area count was recorded at each retention time and percent absorption calculated.

Calculations

Calculation of percent absorption:

$$\frac{\text{Total Area of Control} - \text{Total Area of Sample}}{\text{Total Area of Control}} \times 100$$

The processing parameters for the gas chromatography (GC) are as follows:

Initial Time = 1.00 minutes
Initial Temp. = 35° C
Rate = 10°/minute
Final Temp. = 75° C
Final Time = 0.15
Inj. B = 175° C
Det. B = 300° C
Oven Max. = 300° C
Equib. Time = 0.15
Flow B (He) = 15.0-16.0
Range (Sig. 1) = 4
Zero (Sig. 1) = 2
Attn. (Sig. 1) = 2

The results in the following Table II indicate that the surface area in a sheet form is more efficient than the surface area in a powder form (not attached to a carrier web) for removing odorous substances.

Table III

Sheet Form v. Powder Form % Odor Reduction		
Test Material		
Volatiles	113 mg Absorbent System** in Sheet Form***	108 mg Absorbent System** in Powder Form
Triethylamine	100%	48%
Pyridine	100%	73%
Furaldehyde	100%	81%
Isovaleric Acid	NR*	NR*
n-Propyl sulfide	98%	72%

* NR = no reduction

** Absorbent System contains 100 parts synthetic zeolites, 10 parts non-ionic wetting agent, 10 parts polyvinyl alcohol.

*** Cellulose web of softwood Kraft paper

Tables IV-VI show odor-absorption results, using various odor-absorbing web materials according to the present invention.

Table IV

ABSORBENT SYSTEM ** IN SHEET FORM containing sodium bicarbonate with various binder ratios			
Article	3:1 (absorbent:binder) 196 mg Absorbent System ** in Sheet Form(%)	5:1 (absorbent:binder) 195 mg Absorbent System ** in Sheet Form(%)	10:1 (absorbent:binder) 205 mg Absorbent System ** in Sheet Form(%)
Triethylamine	NR	72	NR
Pyridine	69	90	78
Furaldehyde	97	99	99
Isovaleric Acid	94	85	61
n-Propyl sulfide	21	55	46

*NR = No reduction

**Absorbent system contains 100 parts synthetic zeolite; 10 parts nonionic wetting agent; and amounts of polyvinyl alcohol to provide the specified absorbent:binder ratio in a spunbond/meltblown/spunbond laminate

The results shown here are the gas chromatography headspace analysis results to determine the % of odor reduction in web composites containing synthetic zeolite with sodium bicarbonate at various ratios of binder. This diagram illustrates the absorbing nature of the sheet form at various binder ratios. The binding system is shown to be transparent to odors having 10%-30% binder. As can be seen, the 10% and 20% odor reduction is similar while beginning at 30% the reduction of the sulfide, for example, is being lost.

Table V

ABSORBENT SYSTEM ** IN SHEET FORM of nonwoven web laminate with or without $NaHCO_3$		
Volatiles	202 mg Absorbent System ** in Sheet Form (%)	195 mg Absorbent System ** in Sheet Form + 20% $NaHCO_3$(%)
Triethylamine	*NR	29
Pyridine	93	95
Furaldehyde	98	+99
Isovaleric Acid	*NR	64
n-Propyl Sulfide	87	83

*NR = No reduction

**Absorbent system contains 100 parts synthetic zeolite; 10 parts nonionic wetting agent; 20 parts polyvinyl alcohol in a spunbond/meltblown/spunbond laminate

The results shown are the gas chromatography headspace analysis to determine odor reduction of web composites containing a synthetic zeolite only, and a 5:1 ratio of synthetic zeolite to sodium bicarbonate. The advantage of the zeolite/$NaHCO_3$ system is the removal of acidic odors. In this example the reduction of both the acid and the base has increased with the addition of the sodium bicarbonate.

Table VI

ABSORBENT SYSTEM ** IN SHEET FORM of softwood Kraft paper, with or without $NaHCO_3$		
Volatiles	108 mg Absorbent System ** in Sheet Form (%)	103 mg Absorbent System ** in Sheet Form + 20% $NaHCO_3$(%)
Triethylamine	63	NR*
Pyridine	65	75
Furaldehyde	73	95
Isovaleric Acid	NR*	84
n-Propyl Sulfide	85	92

*NR = No reduction

**Absorbent system contains 100 parts synthetic zeolite; 10 parts nonionic wetting agent; 10 parts polyvinyl alcohol in a cellulose web of softwood Kraft

The results shown are the gas chromatography headspace analysis to determine odor reduction of web composites containing a synthetic zeolite only, and a 5:1 ratio of synthetic zeolite to sodium bicarbonate. The advantage of the zeolite/$NaHCO_3$ system is the removal of acidic odors. The decrease in the reduction of the triethylamine odor is not unexpected because it is a strong base. The weaker base, pyridine is strongly absorbed.

As indicated previously, th odor-absorbing web material of the pr sent invention can be incorporated in catamenial devices in order to prevent odors emanating therefrom. A schematic illustration of the

absorbing portion of a catamenial device (e.g., sanitary napkin) according to the pr sent invention, including placement of the odor-absorbing web material of the present invention, is shown in Fig. 4. Specifically, the illustration shown would have the top adjacent to the body. The fluff (absorbent material 31) would be located inside a tissue layer 39, with an outer cover 35 surrounding the entire structure, the outer cover adjacent the tissue layer surrounding the fluff being adjacent the body. On the side of the fluff furthest from the body is disposed odor-absorbing web material 33. It is preferred that web 33 be disposed on the side of the fluff away from the body, or in the fluff but positioned at a location therein with most of the fluff between the body and web 33, so as to avoid contact of the web with, e.g., body waste fluids. By locating the web in the feminine care product, an effective deodorizer can be provided.

Also shown in Fig. 4 is baffle 37 positioned on the side of the odor-absorbing web material away from the body. Such baffle is provided to avoid any transmission of waste body fluids to the outside.

In the foregoing, each of the fluff material, the outer cover, the baffle and the tissue layer are conventional; location of such components are also conventional. The present invention provides use of the odor-absorbing web material, positioned as set forth in the foregoing, to achieve effective deodorant protection.

The odor-absorbing web material according to the present invention can also be used as part of a tampon. Illustratively, a tight roll of odor-absorbing web material of the present invention could be contained in the core of the tampon, and would be surrounded by the conventional absorbing material such as cotton fiber and/or rayon.

Through use of the odor-absorbing web material of the present invention, the following odorous substances can effectively be absorbed and prevented from emanating from the catamenial device: triethylamine, pyridine, furaldehyde, isovaleric acid and n-propyl sulfide.

As indicated previously, the odor-absorbing web material of the present invention can be incorporated in a package with medical materials, with the medical materials being sterilized by gamma sterilization treatment in the sealed package; the odor-absorbing web material prevents highly offensive odors emanating from the package upon opening the sealed package. The odor-absorbing material of the present invention is substantially inert to the gamma sterilization treatment (for example, treatment at 3.0-3.5 x 10^4 Gy (3.0-3.5 megarads), specifically 3.2 x 10^4 Gy (3.2 megarads) and can perform its odor-absorbing function even after being in the package that has been subjected to the sterilization treatment. Moreover, due to the non-dusting nature of the product of the present invention, upon opening of the sterilized package, the medical material (for example, hospital gown) does not, undesirably, have particulate material, from the odor-absorbing web material, thereon. The use of the odor-absorbing web material in the medical package according to the present invention absorbs the following odorous substances: acetic acid, butyric acid, isobutyric acid and propionic acid.

Fig. 5 shows a side view of an open package of medical material and odor-absorbing sheet material according to this aspect of the present invention. The pack 51 contains a wrapped surgical gown 53 and an odor-absorbent web material 55 of the present invention. As shown in Fig. 5, the odor-absorbent web material is placed at the bottom of the package, between the wrapped surgical gown and the inner side of the package. However, placement of the web material in the package is optional, and it can be at the top of the package, between the top of the wrapped surgical gown and the inner side of the package.

The following Examples illustrate the present invention. While illustrative, they do not limit the present invention, which is defined by the full scope of the appended claims and equivalents thereof.

Example 1

Two spunbond webs were formed from a fiber grade polypropylene polymer resin obtained from Exxon Corp. The webs had an average basis weight of 11 g/m^2 and an average filament diameter greater than 10 µm

In order to form a spunbond/meltblown/spunbond laminate, each of the spunbond webs was joined to opposite sides of a meltblown web formed from a fiber grade polypropylene polymer resin supplied by Exxon Corp. The meltblown web had an average basis weight of 17 g/m^2, and an average filament diameter of less than 10 µm and is well known as exemplified by U.S. Patent No. 3,676,242, the contents of which are incorporated herein by reference. The three layers prepared were then laminated through spot bonding using heat and pressure, according to U.S. Patent No. 4,041,203. The laminate had a total basis weight of 39 g/m^2 and had a void volume of 81%.

The palindromic laminate was then passed through a saturant slurry which was maintained at ambi nt conditions using a dip and squeeze technique.

The components of the saturant slurry were 77.4% by weight water, 16.1% by weight of a synthetic zeolite which may be obtained from Union Carbide Corp. under the designation of "ABSCENTS™", 3.2% by weight of sodium bicarbonate of 99-100% purity, 1.6% by weight of a non-ionic wetting agent composed of octylphenoxy polyethoxyethanol which contains 9-10 mole of ethylene oxide units, the wetting agent being obtained from Rohm & Haas Co. under the designation of "TRITON™ X-100", and 1.6% by weight of a partially hydrolyzed (87-89% hydrolyzed) low viscosity polyvinyl alcohol obtained from Air Products & Chemicals Co., Inc., under the designation of "VINOL™ 205".

The saturated laminate was then dried bv passing the laminate over a steam can having a can pressure or about 4.14 x 10^4 N/m^2 (about 6 psi). Upon weighing, it was determined that the dried, saturated laminate had a saturated loading of about 26 g/m^2. That is, the weight of materials adhering to the laminate was 67% by weight of the laminate prior to its passing through the saturant slurry.

Example 2

Two 10 g/m^2 continuous filament thermoplastic polypropylene webs were prepared and then laminated to a middle layer constructed of 17 g/m^2 microfiber meltblown polypropylene having an average filament diameter of less than 10 microns through spot bonding using heat and pressure according to U.S. Patent No. 4,041,203. The tri-laminate of spunbond/meltblown/spunbond had a total basis weight of 37 g/m^2, and has a void volume of 81%.

The bonded laminate was then saturated using a dip and squeeze size press configuration, with a saturant slurry comprised, in percent by weight, of 80% of water, 14.3% by weight of an odor absorbing 200 mesh * natural zeolite which may be obtained from Zeotex Corp. under the designation of "Zeobrite™", 2.9% by weight of sodium bicarbonate, 1.4% dry weight of an emulified polymeric acrylic latex which may be obtained from B.F. Goodrich under the trade designation of "Hycar®" 26334, 1.4% by weight of a non-ionic wetting agent obtained from Rohm & Haas Co, under the designation of "Triton™ X-100". The saturated laminate was then dried by passing the laminate over a steam can with a can pressure of 4.14x 10^4 N/m^2 (6 psi).

Upon weighing, it was determined that the dried saturated web had a saturant loading of about 25 g/m^2. That is, the weight of the material adhering to the web was 67% by weight of the web prior to its passing through the saturant slurry.

Example 3

A 20 g/m^2 continuous filament thermoplastic polypropylene spunbond web was prepared and then laminated to a 17 g/m^2 microfiber meltblown web of polypropylene having an average filament diameter of less than 10 µm through spot-bonding using heat and pressure according to U.S. Patent No. 4,041,203. The laminate had a void volume of 78% and a total basis weight of 37 g/m^2. The bonded laminate was then saturated using a dip and squeeze size press configuration with a saturant slurry comprised, in percent by weight, of 79.9% of water, 16.7% by weight of an odor-absorbing synthetic zeolite which may be obtained from Union Carbide Corp. under the designation of "ABSCENTS™", 1.7% by weight of hydroxyethylated modified low viscosity starch which may be obtained from Penford Products Co. under the designation of Penford Gum 330, 1.7% by weight of a non-ionic wetting agent composed of octylphenoxy polyethoxyethanol which contains 9-10 moles of ethylene oxide, the wetting agent being obtained from Rohm & Haas Co. under the designation of "Triton™ X-100". The saturated laminate was then dried by passing the laminate over a steam can with a can pressure of 6 psi. *

Upon weighing, it was determined that the dried, saturated laminate had a saturant loading of 26 g/m^2. That is, the weight of materials adhering to the laminate was 67% by weight of the laminate prior to its passing through the saturant slurry.

Example 4

* 74µm

* 4.14 x 10^4 N/m^2

A 96 g/m^2 bone-dry cellulose web of softwood Kraft paper with a void volume of 77% was saturated using a size pressure configuration. Th saturant slurry was comprised, in percent by weight, of 77.4% of water, 16.2% by weight of an odor-absorbing synthetic zeolite which may be obtained from Unicn Carbide Corp. under the designation of "ABSCENTS™", 3.2% by weight of sodium bicarbonate, 1.6% by weight of a non-ionic wetting agent obtained from Rohm & Haas Co. under the designation of "Triton™ X-100", and 1.6% by weight of a partially hydrolyzed low viscosity polyvinyl alcohol obtained from Air Products & Chemicals Co., Inc., under the designation of "Vinol™ 205. The saturated web was then dried over a steam can having a can pressure of about 6 psi. "

Upon weighing, it was determined that the dried saturated web had a saturant loading of about 28 g/m^2. That is, the weight of the materials adhering to the web was 29% by weight of the web prior to its passing through the saturant slurry.

The saturated web was then cut into 5" x 2" strips and placed in maxi-pads as described in connection with Fig. 4 herein. The resultant pads were tested. The headspace testing showed effective absorption of triethylamine, pyridine, furaldehyde, n-propyl sulfide, and isovaleric acid when analyzed by gas chromatography, the results of which are displayed in Table VII.

Table VII

Maxi Pads containing the Absorbent System ** on a cellulose web of softwood Kraft Paper with or without $NaHCO_3$		
Test Materials		
Volatiles	Maxi Pad containing synthetic zeolite Absorbent System ** on cellulose web of softwood Kraft	Maxi Pad containing synthetic zeolite + $NaHCO_3$ Absorbent System ** on cellulose web of softwood Kraft
Triethylamine	76%	67%
Pyridine	89%	91%
Furaldehyde	94%	100%
Isovaleric acid	NR	85%
n-Propyl Sulfide	71%	76%

*NR = No reduction

**Absorbent System = 100 parts synthetic zeolite; 10 parts nonionic wetting agent; 10 parts PVOH in cellulose web of softwood Kraft

Example 5

A trilaminate of spunbond/meltblown/spunbond polypropylene was prepared as described in Example 1, with the total basis weight being 37 g/m^2, and a void volume of 81%. The bonded laminate was then saturated using a dip and squeeze size press configuration with a saturant slurry comprised, in percent by weight, of 77.6% of water, 14.9% of an odor-absorbing synthetic zeolite which may be obtained from Union Carbide Corp. under the designation of "ABSCENTS™", 3.0% by weight sodium bicarbonate, 3.0% by weight of a partially hydrolyzed polyvinyl alcohol obtained from Air Products & Chemicals Co., Inc., under the designation of "Vinol™" 205, 1.5% by weight of a non-ionic wetting agent obtained from Rohm & Haas Co. under the designation of "Triton™ X-100". The saturated web was then dried over a steam can having a can pressure of about 6 psi.

Upon weighing, it was determined that the dried saturated web had a saturant loading of 28 g/m^2. That is, the weight of the material adhering to the laminate was 74% by weight of the laminate prior to its passing through the saturant slurry.

Example 6

A trilaminate of spunbond/meltblown/spunbond polypropylene was prepared as described in Example 1, with the total basis weight being 37 g/m^2. The bonded laminate was then saturated using a dip and squeeze size press configuration with a saturant slurry comprised, in percent by weight, of 77.6% of water, 13.7% of an odor-absorbing synthetic zeolite which may be obtained from Union Carbide Corp. under the designation of "ABSCENTS™", 2.7% by weight sodium bicarbonate, 4.5% by weight of a partially hydrolyzed polyvinyl alcohol obtained from Air Products & Chemicals Co., Inc. under the designation of "Vinol™" 205 and 1.4% by weight of a non-ionic wetting agent obtained from Rohm & Haas Co. under the designation of "Triton™ X-100". The saturated web was then dried over a steam can having a can pressure of about 6 psi.

Upon weighing, it was determined that the dried saturated web had a saturant loading of 28 g/m^2. That is, the weight of the material adhering to the laminate was 74% by weight of the laminate prior to its passing through the saturant slurry.

Example 7

Two 10 g/m^2 continuous filament thermoplastic spunbond webs were prepared, and were then laminated to a middle layer constructed of 17 g/m^2 microfiber meltblown polypropylene web having an average filament diameter of less than 10 microns through spot bonding using heat and pressure according to U.S. Patent No. 4,041,203. The trilaminate of spunbond/meltblown/spunbond had a total basis weight of 37 g/m^2. The bonded laminate was then saturated by being dipped into a saturant slurry comprised, in percent by weight, of 77.6% of water, 14.9% of an odor-absorbing synthetic zeolite which may be obtained from Union Carbide Corp. under the designation of "ABSCENTS™", 1.4% by weight of a non-ionic wetting agent obtained from Rohm & Haas Co. under the designation of "TRITON™ X-100", 3.0% by weight of a partially hydrolyzed low viscosity polyvinyl alcohol obtained from Air Products & Chemicals Co., Inc., under the designation of "VINOL™ 205", and 3.0% by weight sodium bicarbonate. The treated laminate substrate was then squeezed to remove excess saturant, and then dried using a conventional steam can with a can pressure of 6 psi to produce an odor-absorbent web. The dried and saturated web had a saturant loading of 25 g/m^2.

The saturated web was then trimmed to 13" x 10" * and included with treated polypropylene medical fabrics which were sealed in plastic and gamma-sterilized. The resultant package when opened had reduced odor over the medical fabrics without the saturated odor-absorbent material of the present invention.

*33.02 cm x 25.40 cm.

**64.52 cm^2

The headspace of a closed container using 10 $in.^2$ " of the absorbent web showed effective absorption of triethylamine, pyridine, furaldehyde, n-propyl sulfide and isovaleric acid when analyzed by gas chromatography.

While we have shown and described several embodiments in accordance with the present invention, it is understood that the same is not limited thereto, but is susceptible of numerous changes and modifications as are known to one having ordinary skill in the art, and we therefor do not wish to be limited to the details shown and described herein, but intend to cover all such modifications as are encompassed by the scope of the appended claims.

Claims

1. An odor absorbing material comprising a base substrate having an open-pore void volume of at least 50% preferably 75%, the surface areas of the base substrate, which are exposable to the odorous substances, being covered with at least one absorbing particulate material bound to the base substrate by means of a binding system.

2. A material according to claim 1 in which the voids make the material permeable for the odorous substances to pass into contact with all of the odor absorbing particulate material and/or in which the binding system is transparent to the odorous substances to be absorbed.

3. A material of one of the preceding claims obtainable by impregnating the base substrate with a saturant slurry containing in a liquid the at least one odor absorbing particulate material and a binding agent and by subsequently removing the liquid.

4. A material of claim 3 in which the binding agent is transparent to the odorous substances to be absorbed.

5. The material of claim 3 or 4 in which the saturant slurry further contains a wetting agent for wetting the base substrate with the slurry.

6. The material of one of the claims 3 to 5 in which the slurry is an aqueous slurry.

7. The material of one of claims 3 to 6 in which the base substrate is dipped into the saturant slurry further squeezed and subsequently dried.

8. The material of one of the preceding claims wherein the base substrate is a sheet material, preferably a fibrous base web.

9. The material of claim 8 in which on the surface of the individual fibers of the fibrous base web along the entire and around the entire circumference of the fiber particulates of the at least one odor absorbing particulate material are distributed, which are bound to the fibers by the binding agent.

10. The material of one of the preceding claims in which it is a web material.

11. A web material preferably according to claim 8 for absorbing odorous substances, comprising a base web and odor-absorbing particulate material, that can absorb said odorous substances, bound to the base web by a binding system, the binding system including a binding agent, the odor-absorbing particulate material being distributed throughout the base web, the binding system being transparent to the odorous substances, the base web having a percent void volume of greater than 75%.

12. A material according to one of the preceding claims, wherein the base web or base substrate has a property of absorbing odorous substances.

13. A material according to claim 12 wherein the base web or base substrate is a fibrous base web.

14. A material according to claim 13, wherein the fibrous base web is a paper web.

15. A material according to claim 14, wherein the paper web is made of cellulosic fibrous material.

16. A material according to claim 13, wherein the fibrous base web is a non-woven web.

17. A material according to claim 16, wherein the non-woven web is a spunbond web.

18. A material according to claim 16, wherein the non-woven web is a web of meltblown fibers.

19. A material according to claim 16, wherein the non-woven web is a laminate of at least two layers.

20 . The material according to claim 19, wherein the at least two layers include a spunbond web and a web of meltblown fibers, bonded to each other.

21. A material according to claims 19 or 20, wherein the at least two layers include two spunbond webs and a web of meltblown fibers, the web of meltblown fibers being sandwiched between the two spunbond webs.

22. A material according to one of claims 16 to 21, wherein the non-woven web is made of polypropylene fibers.

23. A web material according to on of the preceding claims, wherein th odor-absorbing particulate material is selected from the group consisting of zeolites, activated carbon, chitin, and ion-exchange resins.

24. A material according to claim 23, wherein th zeolite is natural zeolite.

25. A material according to claim 23, wherein the zeolite is a synthetic zeolite.

26. A material according to one of claims 23 to 25 wherein the zeolite is white.

27. A material according to one of the preceding claims wherein the binding agent is selected from the group consisting of a polyvinyl alcohol, a starch and derivatives thereof, and a polymer from a polymer emulsion.

2.8. A material according to claim 27, wherein the polymer emulsion is a latex.

29. A material according to one of the preceding claims wherein the binding agent is a polymer from a polymer emulsion, the polymer being selected from the group consisting of an acrylic polymer, styrene butadiene rubber, acrylonitrile butadiene rubber, acrylonitrile butadiene styrene polymer, vinyl chloride polymer, polyvinyl acetate, and ethylene vinyl acetate polymer.

30. A material according to claim 27, wherein the starch derivative is a ethylated starch derivative or oxidized starch derivative.

31. A material according to claim 27, wherein the polyvinyl alcohol is a partially hydrolyzed polyvinyl alcohol.

32. A material according to claim 31, wherein the partially hydrolyzed polyvinyl alcohol is hydrolyzed 87%-89%.

33. A material according to one of the preceding claims wherein the web material also inclu particles of an alkaline salt or alkaline earth oxide, for removal of acidic odorous sustances, the alkaline salt or alkaline earth oxide being bound to the fibers of the base web by the binding system or binding agent.

34. A material according to claim 33, wherein the alkaline salt or alkaline earth oxide is selected from the group consisting of sodium bicarbonate, potassium bicarbonate, lithium bicarbonate, sodium carbonate, potassium carbonate, disodium hydrogen phosphate, sodium dihydrogen phosphate, trisodium phosphate, magnesium oxide, calcium oxide, tetrasodium pyrophosphate, tetrapotassium pyrophosphate, tetralithium pyrophosphate and disodium dihydrogen pyrophosphate.

35. A web material according to one of the preceding claims, the odor-absorbing particulate material and binding agent forming part of an add-on to the base web, the add-on being part of the web material in an amount of 15-75 parts by weight per 100 parts by weight of base web.

36. A material according to claim 34, wherein the add-on further includes a wetting agent and alkaline salt or alkaline earth oxide particles.

37. A material according to claim 35 or 36, wherein the add-on includes, for every 100 parts by weight of odor-absorbing particulate material, 1-40, preferably 5-25 parts by weight alkaline salt or alkaline earth oxide, 5-15 parts by weight wetting agent and 5-50 parts by weight binder.

38. A saturant slurry, to be impregnated into a base web so as to form a material for absorbing odorous substances, especially according to one of tne preceding claims comprising odor-absorbing particulate material for absorbing the odorous substances, a wetting agent for wetting the base web with the slurry, and a binding agent, in water.

39. A slurry according to claim 38 , wherein said slurry further includes an alkaline salt or alkaline earth oxide.

40. A slurry according to claim 38 or 39, wherein the wetting agent is selected from the group consisting of anionic surfactants and nonionic surfactants.

41. A slurry according to one of claims 38 or 39, wherein the wetting agent is a fugative alkyl alcohol.

42. A slurry according to one of claims 38 or 39 wherein the wetting agent is a phenoxypolyethoxyethanol.

43. The slurry according to one of claims 38 to 42, comprising, for every 100 parts by weight odor-absorbing particulate material, 5-15 parts by weight wetting agent, and 5-50 parts by weight binder.

44. The slurry according to one of claims 38 to 42, wherein the slurry further contains an alkaline salt or alkaline earth oxide, and wherein the slurry comprises, for every 100 parts by weight odor-absorbing particulate material, 5-15 parts by weight wetting agent, 5-40 parts by weight alkaline salt or alkaline earth oxide and 5-50 parts by weight binding agent.

45. The slurry of one of claims 38 to 44 wherein the odor-absorbing particulate material in the slurry is zeolite.

46. A method of forming a material for absorbing odorous substances, comprising the steps of:
dipping a base web into a saturant slurry, the base web having a percent void volume greater than 75%, the saturant slurry being an aqueous slurry including, in addition to water, odor-absorbing particulate material for absorbing odorous substances, a binding agent and a wetting agent, said dipping acting to incorporate the saturant slurry throughout the base web, whereby the odor-absorbing particulate material can be distributed throughout the bas web; and

drying the dipped fibrous base web.

47. A method according to claim 46, wherein the web bas is a fibrous web base.

48. A method according to claim 46 or 47, comprising the further step, after said dipping and prior to said drying, of squeezing the base web having saturant slurry incorporated therein, so as to control the amount of saturant slurry incorporated in the base web.

49. A method according to one of claim 46 to 48, wherein the odorous absorbing particulate material is a zeolite.

50. A method according to one of claims 46 to 49 wherein the saturant slurry further includes an alkaline salt or alkaline earth oxide, whereby alkaline salt or alkaline earth oxide can also be distributed throughout the base web.

51. A method according to one of claims 46 to 50 wherein the base web is in the form of a continuous roll of web material, the web material being continuously conveyed so as to dip into a bath containing said saturant slurry and then pass between a pair of rollers to squeeze the base material having saturant slurry incorporated throughout, the web material then being dried.

52. Product produced by the process of one of claims 46 to 51.

53. Use of a material of one of claims 1 to 37 in a catamenial device for absorbing waste fluids from the body comprising liquid-absorbing material, preferably in a sanitary napkin or a tampon.

54. Use of claim 53 in which the material is positioned such that at least a part of the liquid-absorbing material is between the body and said material or that said material is positioned on a side of the liquid absorbing material opposite to the side of the liquid absorbing material closest to the body.

55. Use of a material of one of claims 1 to 37 within a medical material package comprising an enveloping member having the medical material sealed therein.

56. A catamenial device, for absorbing waste fluids from the body, comprising liquid-absorbing material, and a material according to one of claims 1 to 37 for absorbing odorous substances, the odorous substances being odorous substances emanating from the waste fluids absorbed in the liquid-absorbing material, said web material being positioned such that at least a part of the liquid-absorbing material is between the body and said web material.

57. A catemenial device according to claim 37, wherein said material is positioned on a side of the liquid-absorbing material opposite to the side of the liquid-absorbing material closest to the body.

58. A catamenial device according to claim 56 or 57, wherein the catamenial device is a sanitary napkin.

59. A catamenial device according to claim 56, wherein the catamenial device is a tampon.

60. A medical material package (51) comprising an enveloping member for having the medical material (53) sealed therein, the medical material, and said material (55) for absorbing odorous sustances according to one of claims 1 to 37.

61. A medical material package according to claim 60 wherein the enveloping member has said medical material and said material sealed therein, the sealed package having been subjected to gamma sterilization.

62. A medical material packaged according to claim 61, in which the odorous substances being odorous substances, in the sealed package, caused by the gamma sterilization.

63. A medical material package according to claim 60 to 62, wherein the medical material is a hospital gown.

64. A catamenial device comprising:

a cover layer (35)

an absorbing material pad (31) adapted to absorb liquid waste from a body; and

a barrier layer (37) for preventing liquid waste from passing out of the catamenial device;

wherein the device further includes a web (33) for absorbing odorous substances, the odorous substances being odorous substances emanating from liquid from a body in the absorbing material pad, the web comprising a fibrous base and odor-absorbing particulate material, for absorbing the odorous substances, bound to the fibers of the fibrous base by a binding agent, the odor-absorbing particulate material being distributed through the base web, the binding agent being transparent to the odorous substances, the web for absorbing odorous substances being positioned such that at least a portion of the absorbing material is positioned between the body and the web for absorbing odorous substances, and the web for absorbing odorous substances is closer to the body than is the barrier layer.

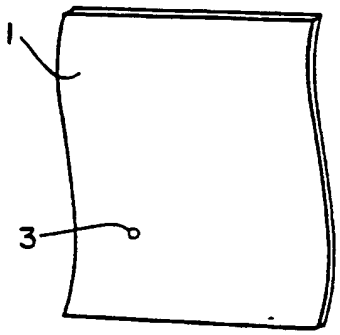


FIG. 1a

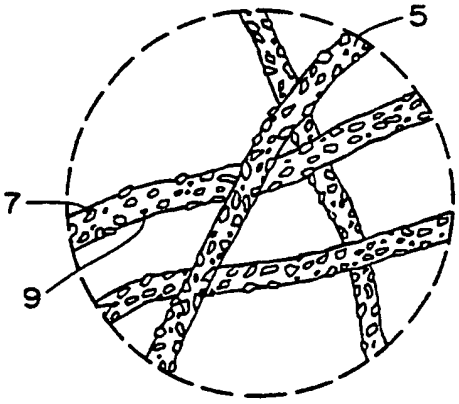


FIG. 1b

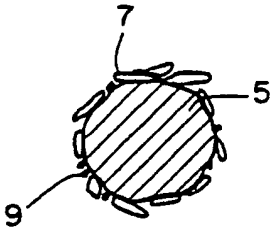


FIG. 2

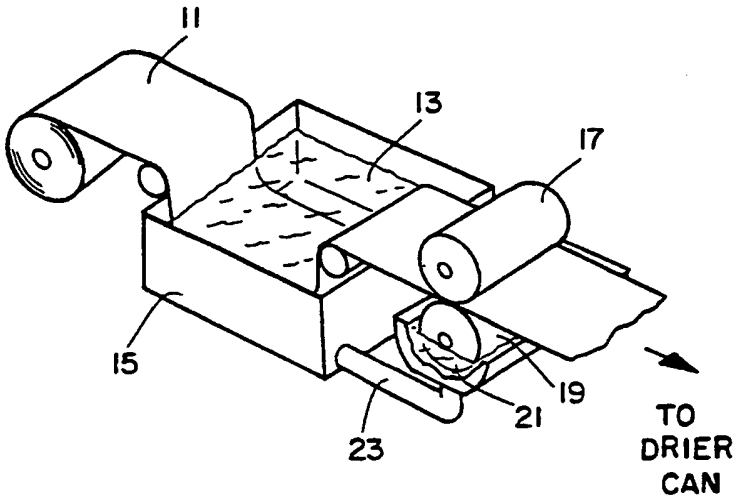


FIG. 3

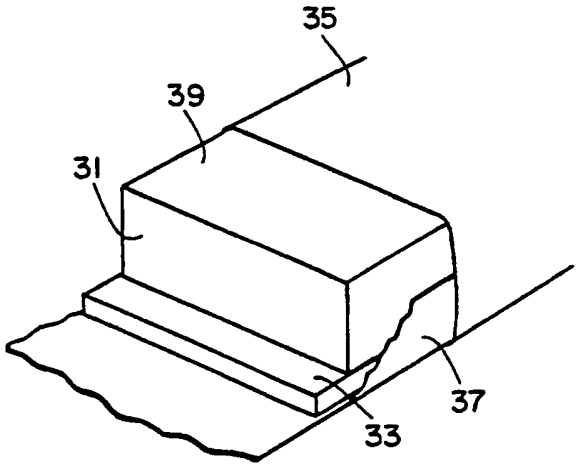


FIG. 4

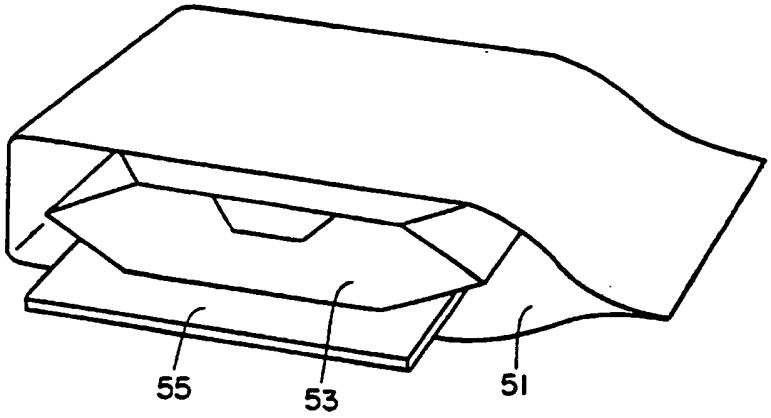


FIG. 5